

PRECAST CONCRETE BRIDGE SYSTEM

42. ALL PRECAST CONCRETE ELEMENTS TO BE FABRICATED TO THE SPECIFIED DIMENSIONS WITHIN THE TOLERANCES DICTATED IN THE PRECAST/PRESTRESSED CONCRETE INSTITUTE TOLERANCE MANUAL FOR PRECAST AND PRESTRESSED CONCRETE CONSTRUCTION, MNL 135-00, AND ITS LATEST REVISIONS.
43. THE DESIGN AND DETAILING OF THE PRECAST CONCRETE ARCH AND WINGWALLS AND ALL DETAILS, APPURTENANCES, AND CONNECTIONS FOR THE ARCH AND WINGWALLS, INCLUDING THE CONNECTION BETWEEN THE ARCH/WINGWALL CONNECTION WITH THE PEDESTAL WALLS SHALL BE THE CONTRACTOR'S RESPONSIBILITY. DESIGN SHALL BE BASED ON THE CURRENT AASHTO AND VTRANS STANDARDS USING LOAD AND RESISTANCE FACTOR DESIGN (LRFD). THE JOINTS BETWEEN THE PRECAST ARCH SECTIONS SHALL BE WATERTIGHT UTILIZING FLEXIBLE RUBBER OR PLASTIC GASKETS. MECHANICAL DEVICES SHALL BE USED TO LOCK THE INDIVIDUAL SECTIONS TOGETHER. THE MANUFACTURER SHALL PROVIDE STAMPED DESIGN CALCULATIONS PREPARED BY A REGISTERED VERMONT PROFESSIONAL ENGINEER. THE MANUFACTURER SHALL CONSIDER STRENGTH, SERVICEABILITY, STIFFNESS, AND STABILITY OF THE PRECAST ELEMENTS FOR LOADS GENERATED DURING FABRICATION, TRANSPORTATION, ERECTION, CONSTRUCTION OPERATIONS, AND ULTIMATE TRAFFIC CONDITIONS. THE MANUFACTURER SHALL OBTAIN WRITTEN APPROVAL FROM THE VERMONT AGENCY OF TRANSPORTATION STRUCTURES SECTION PRIOR TO FABRICATION. THE DESIGN SHALL INCLUDE A LOAD RATING COMPLETED USING THE LOAD AND RESISTANCE FACTOR RATING METHOD AND CONFORMING TO STANDARD VTRANS PRACTICE. ALL COSTS WILL BE CONSIDERED INCIDENTAL TO ITEM 540.10, "PRECAST CONCRETE STRUCTURE (7'-0" X 20'-0" X 110'-0" ARCH) OR ITEM 540.10, "PRECAST CONCRETE STRUCTURE (WINGWALLS)", AS APPLICABLE.
44. THE ARCH LAYOUT WAS DETERMINED ASSUMING A TOP CENTER ROOF THICKNESS OF 10" AND INSTALLATION OF AN 7'-0" RISE X 20'-0" SPAN ARCH. THE CONTRACTOR MAY UTILIZE AN ARCH OR FRAME WITH ALTERNATE GEOMETRY FROM THAT SHOWN IN THE PLANS. HOWEVER, IF THE THICKNESSES OF THE STRUCTURE SHAPE VARY FROM THE ASSUMED DIMENSIONS, INVERT ELEVATIONS SHALL REMAIN THE SAME, AND STRUCTURE SPAN, RISE, AND WATERWAY OF FULL OPENING SHALL REMAIN THE SAME OR GREATER. THE HEADWALL SHALL BE ADJUSTED TO MAINTAIN THE PROPOSED ROADWAY PROFILE AND SIDE SLOPE GRADES.
45. QUANTITIES SHOWN FOR STRUCTURAL EARTHWORK AND HIGH PERFORMANCE CONCRETE CLASS B ARE BASED ON THE ASSUMED STRUCTURE DIMENSIONS SHOWN AND SHALL NOT BE UTILIZED BY THE FABRICATOR AS REQUIRED DIMENSIONS FOR THE STRUCTURE. THESE ITEMS WILL BE PAID AS FINAL PLAN QUANTITIES (FPQ) ACCORDING TO SECTION 109.10. IF ACTUAL QUANTITIES VARY, NO ADDITIONAL COMPENSATION WILL BE ALLOWED.
46. THE PRECAST BRIDGE SYSTEM SHALL BE DESIGNED PER THE AASHTO LRFD BRIDGE DESIGN SPECIFICATIONS, DATED 2014, AND ITS LATEST REVISIONS, AND SHALL CONSIDER THE FOLLOWING DESIGN CRITERIA:
- A. DESIGN LOADING: HL-93
  - B. WEIGHT OF BACKFILL MATERIAL: 125 PCF
  - C. PRECAST CONCRETE COMPRESSIVE STRENGTH:  $f'c = 5,000$  PSI
  - D. REINFORCING STEEL, LEVEL 1:  $f_y = 60,000$  PSI
47. THE CAST-IN-PLACE CONCRETE ARCH PEDESTAL WALLS AND MAT FOUNDATION WERE DESIGNED ASSUMING FULL PORE PRESSURE BELOW THE GROUNDWATER ELEVATION AS SHOWN IN THE BORINGS INCLUDING UPLIFT ON THE MAT FOUNDATION AND UTILIZING THE FOLLOWING UNFACTORED ARCH REACTIONS:
- |                         |                   |                      |
|-------------------------|-------------------|----------------------|
| VERTICAL LOAD PER LEG   | (SELF WEIGHT) DC: | 2.20 KLF             |
|                         | (EARTH COVER) EV: | 20.30 KLF            |
|                         | (LIVE LOAD) LL:   | 1.90 KLF             |
| HORIZONTAL LOAD PER LEG | (OUTWARD THRUST)  |                      |
|                         | (SELF WEIGHT) DC: | 0.00 KLF TO 1.00 KLF |
|                         | (EARTH COVER) EV: | 0.00 KLF TO 6.50 KLF |
|                         | (LIVE LOAD) LL:   | 0.00 KLF TO 1.00 KLF |

PRECAST CONCRETE BRIDGE SYSTEM (CONTINUED)

- THE CAST-IN-PLACE CONCRETE DOWNSTREAM WINGWALL PEDESTAL WALLS WERE DESIGNED ASSUMING PRECAST CONCRETE ANCHORS TAKE THE FULL LATERAL LOAD ABOVE THE PEDESTAL WALL AND FULL PORE PRESSURE BELOW THE APPROXIMATE GROUNDWATER ELEVATION AS SHOWN IN THE BORINGS INCLUDING UPLIFT ON THE MAT FOUNDATION AND UTILIZING A PRECAST CONCRETE WINGWALL STEM VERTICAL LOAD (DC) EQUAL TO 1.91 KIP.
- THE CAST-IN-PLACE CONCRETE UPSTREAM WINGWALL PEDESTAL WALLS WERE DESIGNED ASSUMING PRECAST CONCRETE ANCHORS TAKE THE FULL LATERAL LOAD ABOVE THE PEDESTAL WALL AND FULL PORE PRESSURE BELOW THE WEEPHOLES INCLUDING UPLIFT ON THE MAT FOUNDATION AND UTILIZING A PRECAST CONCRETE WINGWALL STEM VERTICAL LOAD (DC) EQUAL TO 1.67 KIP.
- IF A CHANGE IN STRUCTURE GEOMETRY OR TYPE RESULTS IN DESIGN LOADS THAT VARY FROM THE ABOVE LOADS, THE CONTRACTOR SHALL PROVIDE THESE LOADS TO THE ENGINEER. NO ADDITIONAL COMPENSATION WILL BE PROVIDED FOR CALCULATING OR SUBMITTING THESE LOADS. THE ENGINEER SHALL UPDATE THE MAT FOUNDATION AND PEDESTAL WALL DESIGN CALCULATIONS TO ACCOMMODATE THE ACTUAL PROVIDED DESIGN LOADS AND PROVIDE THE REVISED MAT FOUNDATION AND PEDESTAL WALL DIMENSIONS AND REINFORCING CHANGES TO THE CONTRACTOR.
48. DESIGN AND WORKING DRAWINGS SHALL BE SUBMITTED FOR APPROVAL AND SHALL SHOW REINFORCING BAR SIZES AND LOCATIONS, JOINT DETAILS, AND OTHER DETAILS NECESSARY TO MANUFACTURE THE ELEMENTS. ALL COSTS FOR THE DESIGN, DRAWINGS, FABRICATION, DELIVERY, AND ERECTION OF ALL THE PRECAST STRUCTURE ELEMENTS WILL BE CONSIDERED INCIDENTAL TO ITEM 540.10, "PRECAST CONCRETE STRUCTURE (7'-0" X 20'-0" X 110'-0" ARCH) OR ITEM 540.10, "PRECAST CONCRETE STRUCTURE (WINGWALLS)", AS APPLICABLE, INCLUDING ANY INCIDENTALS NECESSARY TO FURNISH THE PRODUCT COMPLETE IN PLACE.
49. THE COST OF ANY CAST-IN-PLACE CONCRETE PROPOSED TO BE USED IN CONJUNCTION WITH PRECAST CONCRETE ELEMENTS (NOT INCLUDING THE CAST-IN-PLACE CONCRETE PEDESTAL WALLS AND MAT FOUNDATION DETAILED IN THE CONTRACT PLANS), IF APPLICABLE, WILL BE CONSIDERED INCIDENTAL TO ITEM 540.10, "PRECAST CONCRETE STRUCTURE (7'-0" X 20'-0" X 110'-0" ARCH) OR ITEM 540.10, "PRECAST CONCRETE STRUCTURE (WINGWALLS)", AS APPLICABLE, INCLUDING ANY REINFORCEMENT OR INCIDENTALS NECESSARY TO PLACE THE CAST-IN-PLACE CONCRETE.
50. THE COST OF ALL REINFORCING BARS THAT ARE CAST INTO THE PRECAST CONCRETE ARCH AND HEADWALLS SHALL BE INCLUDED IN ITEM 540.10, "PRECAST CONCRETE STRUCTURE (7'-0" X 20'-0" X 110'-0" ARCH)". THE COST OF ALL REINFORCING BARS THAT ARE CAST INTO THE PRECAST CONCRETE WINGWALLS WILL BE INCLUDED UNDER PAY ITEM 540.10, "PRECAST CONCRETE STRUCTURE (WINGWALLS)".
51. GALVANIZED STEEL ANGLES AND BOLTS AS SHOWN IN ARCH JOINT DETAIL (SHEET 43) SHALL BE UTILIZED TO DRAW ARCH SECTIONS TOGETHER. THESE HARDWARE ASSEMBLIES SHALL BE ATTACHED AS SHOWN ON THE DETAIL AND SHALL BE LEFT IN PLACE. COST WILL BE CONSIDERED INCIDENTAL TO ITEM 540.10, "PRECAST CONCRETE STRUCTURE (7'-0" X 20'-0" X 110'-0" ARCH)".
52. JOINTS BETWEEN ABUTTING PRECAST UNITS SHALL BE WATERTIGHT. THE EXTERIOR SIDE/VERTICAL JOINTS AND OTHER AREAS TO BE FILLED ON A VERTICAL SURFACE SHALL BE FILLED USING A VERTICAL OVERHEAD MATERIAL FROM THE APPROVED PRODUCTS LIST. THE EXTERIOR TOP/HORIZONTAL JOINTS SHALL BE FILLED WITH MORTAR, TYPE IV, AFTER BEING SET IN THEIR FINAL POSITION. MORTAR SHALL BE WET CURED A MINIMUM OF 4 HOURS PRIOR TO APPLYING WATERPROOFING MEASURES. VERTICAL OVERHEAD MATERIAL AND MORTAR WILL BE CONSIDERED INCIDENTAL TO ITEM 540.10, "PRECAST CONCRETE STRUCTURE (7'-0" X 20'-0" X 110'-0" ARCH)".

PRECAST CONCRETE BRIDGE SYSTEM (CONTINUED)

53. THE CONTRACTOR SHALL FOLLOW THE MANUFACTURER'S RECOMMENDATIONS REGARDING BACKFILL AND COMPACTION LIMITS, PROPERTIES, AND PROCEDURES, INCLUDING RESTRICTIONS OF CONSTRUCTION MACHINERY AND OPERATIONS.
54. THE CONTRACTOR SHALL PROVIDE EQUIPMENT CAPABLE OF UNLOADING, LIFTING, AND PLACING PRECAST UNITS IN ACCORDANCE WITH THE MANUFACTURER'S FIELD REPRESENTATIVE. COST WILL BE CONSIDERED INCIDENTAL TO ITEM 540.10, "PRECAST CONCRETE STRUCTURE (7'-0" X 20'-0" X 110'-0" ARCH)" OR ITEM 540.10, "PRECAST CONCRETE STRUCTURE (WINGWALLS)", AS APPLICABLE.
55. PRIOR TO SHIPPING THE PRECAST ELEMENTS, THE CONTRACTOR SHALL SUPPLY CERTIFICATION STATING THAT THE BACKFILL SOIL MEETS THE REQUIREMENTS OF THE PROJECT SPECIFICATIONS. NO BACKFILL SHALL BE PLACED AGAINST ANY STRUCTURAL ELEMENTS PRIOR TO APPROVAL OF THE ENGINEER. PAYMENT WILL BE CONSIDERED INCIDENTAL TO ITEM 204.30.
56. THE DRILLING OF HOLES IN THE PRECAST ELEMENTS SHALL NOT BE PERMITTED, UNLESS APPROVED IN WRITING BY THE VERMONT AGENCY OF TRANSPORTATION STRUCTURES SECTION. ANY LIFTING HOLES SHALL BE FILLER WITH MORTAR, TYPE IV. COST FOR MORTAR WILL BE CONSIDERED INCIDENTAL TO ITEM 540.10, "PRECAST CONCRETE STRUCTURE (7'-0" X 20'-0" X 110'-0" ARCH)" OR ITEM 540.10, "PRECAST CONCRETE STRUCTURE (WINGWALLS)", AS APPLICABLE.
57. THE CONTRACTOR SHALL REPAIR ANY DAMAGE TO PRECAST CONCRETE ELEMENTS AT THE CONTRACTOR'S EXPENSE AND TO THE SATISFACTION OF THE ENGINEER.
58. A 2 FOOT WIDE STRIP OF TORCH APPLIED MEMBRANE WATERPROOFING SHALL BE APPLIED AT EACH OUTER SIDE JOINT OF THE ARCH AND WINGWALLS, INCLUDING THE JOINT BETWEEN THE ARCH AND EACH WINGWALL. ON THE ARCH, THE MEMBRANE SHALL BE CENTERED ON THE JOINT AND COVER THE FULL HEIGHT OF THE SIDE JOINTS AND EXTEND 1'-0" BELOW THE TOP OF THE PEDESTAL WALLS. ON THE WINGWALLS, THE MEMBRANE SHALL BE CENTERED ON THE JOINT AND EXTEND FROM 6" BELOW THE TOP OF THE WINGWALL TO 1'-0" BELOW THE TOP OF THE PEDESTAL WALLS. THE ENTIRE TOP OF THE ARCH SHALL THEN BE COVERED WITH MEMBRANE. THE MEMBRANE SHALL OVERLAP THE EDGES BY 1'-0" ON EACH SIDE. MEMBRANE SHALL ALSO BE APPLIED ALONG THE FULL LENGTH OF THE PEDESTAL WALL/ARCH LEG JOINT AND THE PEDESTAL WALL/WINGWALL STEM JOINT. MEMBRANE WILL BE PAID UNDER CONTRACT ITEM 519.20, "SHEET MEMBRANE WATERPROOFING, TORCH APPLIED)".
59. A 3" DIAMETER PERFORATED PVC DRAIN PIPE SHALL BE INSTALLED BEHIND THE ARCH HEADWALLS AND UPSTREAM WINGWALLS PER THE FABRICATOR'S SPECIFICATIONS AND SHALL BE PLACED WITHIN A MINIMUM 16" THICK ZONE OF DRAINAGE AGGREGATE CONFORMING TO SUBSECTION 704.16. STONE SHALL BE COMPLETELY SEPARATED FROM THE IN SITU SOILS BY GEOTEXTILE CONFORMING TO THE REQUIREMENTS OF SECTION 649, GEOTEXTILE FOR UNDERDRAIN TRENCH LINING. PERFORATED PVC PIPE SHALL BE LAID WITH PERFORATIONS DOWN. THIS WORK AND MATERIALS WILL BE CONSIDERED INCIDENTAL TO ITEM 540.10, "PRECAST CONCRETE STRUCTURE (7'-0" X 20'-0" X 110'-0" ARCH)" OR ITEM 540.10, "PRECAST CONCRETE STRUCTURE (WINGWALLS)", AS APPLICABLE.
60. WEEPHOLES IN THE UPSTREAM WINGWALLS AND ARCH HEADWALLS SHALL BE PLACED APPROXIMATELY EVERY 10'-0" OR AS INDICATED ON THE PLANS. WEEPHOLES SHALL BE SCREENED TO RETAIN CRUSHED STONE (MAXIMUM 1#2" SQUARE OPENINGS) AND TO PREVENT ENTRY BY ANIMALS.
61. THE SIDE SLOPES SHALL BE GRADED TO MATCH THE TOP OF THE WINGWALL ELEVATIONS, AS SHOWN.

MODEL: Sheet 02  
CLD 12-0106



PROJECT NAME:	LUNENBURG
PROJECT NUMBER:	NH CULV(27)
FILE NAME:	11b294/cos/z11b294gennotes.dgn PLOT DATE: 8/24/2015
PROJECT LEADER:	J. BYATT
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GENERAL NOTES SHEET 2	CHECKED BY: S. BEAUMONT SHEET 10 OF 74